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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/334,671	06/17/1999	HENRI M. ROUGEOT	462-USA	5592

7590 09/06/2002

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EXAMINER	
LEE, SHUN K	

ART UNIT	PAPER NUMBER
2878	

DATE MAILED: 09/06/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

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Office Action Summary	Application No.	Applicant(s)
	09/334,671	ROUGEOT ET AL.
	Examiner	**Art Unit**
	Shun Lee	2878

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _3_ MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _12 November 2001 (received 12/19/01)_.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _1-21_ is/are pending in the application.

4a) Of the above claim(s) ____ is/are withdrawn from consideration.

5)☐ Claim(s) ____ is/are allowed.

6)☒ Claim(s) _1-21_ is/are rejected.

7)☐ Claim(s) ____ is/are objected to.

8)☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _17 June 1999_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on ____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. ____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1)☐ Notice of References Cited (PTO-892)
2)☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3)☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) ____
4)☐ Interview Summary (PTO-413) Paper No(s) ____
5)☐ Notice of Informal Patent Application (PTO-152)
6)☐ Other

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

3. Claims 1-5 and 20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Schiebel *et al.* (US 5,396,072).

In regard to claim **1**, Morton discloses (Fig. 6) an indirect x-ray image detector suitable for radiology, comprising an active matrix substrate (102, FET 31) with scanning and read-out circuits (see Fig. 2), wherein over said active matrix substrate (102, FET 31) there is deposited a co-planar thin photoreceptor (201, 203, 204 in Fig 7; column 10, line 35 to column 11, line 23), said photoreceptor being covered with a light-transparent biasing electrode (202) on top of which there is provided an x-ray

conversion scintillator (300). The detector of Morton lacks that the co-planar thin photoreceptor is a photosensitive amorphous selenium multilayer structure. Schiebel *et al.* teach (Fig. 3b) a photosensitive amorphous selenium multilayer structure (32, blocking layers 31, 33) that is of n-i-p or p-i-n type (*i.e.*, blocking layers interchanged; column 6, lines 50-56), wherein the i-layer sandwiched between the n and p layers is an amorphous selenium layer, the n-layer is a hole blocking layer (column 5, lines 43-46), and the p-layer is an electron blocking layer (column 5, lines 29-33) in order to minimize charge injection from the electrodes so as to reduce dark current (column 1, line 58 to column 2, line 1). Therefore it would have been obvious to one having ordinary skill in the art to provide a photosensitive amorphous selenium multilayer structure as the photoreceptor in the detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **2** which is dependent on claim 1, Morton also discloses (Fig. 6) where the active matrix substrate is a two dimensional array of thin film transistors (TFT; *i.e.*, field effect transistor FET 31) associated with a storage capacitance (10) and having conduction pads with electric connection to the photoreceptor (201).

In regard to claim **3** which is dependent on claim 2, Morton also discloses (Fig. 6) a storage capacitance (10 which is formed by drain electrode 134 and pixel electrode 103) that is a part of the TFT architecture (FET 31).

In regard to claim **4** which is dependent on claim 2, Morton also discloses (Fig. 6) a storage capacitance (20 which is formed by electrode 202 and electrode 101) that is an integral part of the photoreceptor (201).

In regard to claim **5** which is dependent on claim 2, Morton also discloses that the TFT (FET 31 in Fig. 6) are made of amorphous silicon (*i.e.*, a-Si:H; column 7, lines 15-17 and column 1, lines 24 and 25).

In regard to claim **20** which is dependent on claim 1, Morton also discloses that the scintillator (300 in Fig. 6) is made of a cesium iodide material (column 7, lines 33-35).

4. Claims 6-11, 15-17, and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Schiebel *et al.* (US 5,396,072) as applied to claim 1 above, and further in view of Polischuk *et al.* (US 5,880,472).

In regard to claim **6** which is dependent on claim 1, the modified detector of Morton lacks a photosensitive selenium multilayer structure that is of n-i-p or p-i-n type, wherein the n-layer is a hole blocking layer, the p-layer is an electron blocking layer and the i-layer sandwiched between the n and p layers is an amorphous selenium layer doped with chlorine and arsenic. Schiebel *et al.* teach (Fig. 3b) a photosensitive selenium multilayer structure (32, blocking layers 31, 33) that is of n-i-p or p-i-n type (*i.e.*, blocking layers interchanged; column 6, lines 50-56), wherein the i-layer sandwiched between the n and p layers is an amorphous selenium layer, the n-layer is a hole blocking layer (column 5, lines 43-46), and the p-layer is an electron blocking layer (column 5, lines 29-33) in order to minimize charge injection from the electrodes

so as to reduce dark current (column 1, line 58 to column 2, line 1). Polischuk *et al.* teach that an amorphous selenium photoconductive layer (*i.e.*, i-layer) is normally doped with arsenic and chlorine (column 7, lines 9-12). Therefore it would have been obvious to one having ordinary skill in the art to provide a photosensitive selenium multilayer structure that is of n-i-p or p-i-n type in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **7** which is dependent on claim 6, the modified detector of Morton lacks an i-layer of amorphous selenium that is doped with chlorine (*e.g.*, 1-100 ppm) and arsenic (*e.g.*, 0.1-5%). Polischuk *et al.* also teach (column 7, lines 9-12) that the i-layer of amorphous selenium is normally doped with chlorine (*e.g.*, 1-100 ppm) and arsenic (*e.g.*, 0.1-5%) to function as the photoconductive layer. Therefore it would have been obvious to one having ordinary skill in the art to provide an i-layer of amorphous selenium that is doped with chlorine (*e.g.*, 1-100 ppm) and arsenic (*e.g.*, 0.1-5%) in the modified detector of Morton, in order for the i-layer to function as a photoconductive layer as taught by Polischuk *et al.*

In regard to claim **8** which is dependent on claim 6, the modified detector of Morton lacks a n-layer that is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal. Schiebel *et al.* also teach that the n-layer is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal (column 5, lines 46-49) in order to minimize charge injection from the electrodes so as to reduce dark current (column 1, line 58 to column 2, line 1). Therefore it would have

been obvious to one having ordinary skill in the art to provide a n-layer that is a thin selenium layer doped with an alkaline metal or an oxide or halogenide of said metal in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **9** which is dependent on claim 8, the detector of Morton lacks that the alkaline metal is selected from lithium, sodium, potassium and cesium. Schiebel *et al.* also teach that the alkaline metal is selected from lithium, sodium, potassium and cesium (column 5, lines 46-49). Therefore it would have been obvious to one having ordinary skill in the art to provide a n-layer that is a thin selenium layer doped with an alkaline metal (*e.g.*, lithium, sodium, potassium, cesium) or an oxide or halogenide of said metal in the detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **10** which is dependent on claim 6, the modified detector of Morton lacks a p-layer that is a thin layer of arsenic enriched amorphous selenium. Polischuk *et al.* also teach that the p-layer is a thin layer of arsenic enriched amorphous selenium (column 9, lines 16-21) in order to minimize charge injection from the electrodes (column 7, lines 22-30). Therefore it would have been obvious to one having ordinary skill in the art to provide a p-layer that is a thin layer of arsenic enriched amorphous selenium in the modified detector of Morton, in order to minimize charge injection from the electrodes as taught by Polischuk *et al.*

In regard to claim **11** which is dependent on claim 10, the modified detector of Morton lacks a p-layer with an arsenic enrichment of 1-38% by wt. Polischuk *et al.* also

teach that the arsenic enrichment of the p-layer is 1-38% by wt (column 9, lines 16-21) in order to minimize charge injection from the electrodes (column 7, lines 22-30). Therefore it would have been obvious to one having ordinary skill in the art to provide a p-layer that is a thin layer of arsenic enriched amorphous selenium in the modified detector of Morton, in order to minimize charge injection from the electrodes as taught by Polischuk *et al.*

In regard to claim **15** which is dependent on claim 6, the modified detector of Morton lacks an electrode formed by indium tin oxide. Electrodes formed by indium tin oxide are well known in the art. For example, Polischuk *et al.* teach (column 7, lines 9-12) that the light transparent biasing electrode is a co-planar indium tin oxide (ITO) layer (column 9, lines 39-44) which is well known in the art (column 4, lines 29-38) and commercially available (column 9, lines 10-13). Therefore it would have been obvious to one having ordinary skill in the art to provide an electrode formed by indium tin oxide in the modified detector of Morton.

In regard to claim **16** which is dependent on claim 6, the modified detector of Morton lacks a selenium based multilayer structure that is of the p-i-n type and the light transparent biasing electrode is set to a negative potential. Schiebel *et al.* also teach that the selenium based multilayer structure is of the p-i-n type and the light transparent biasing electrode is set to a negative potential (*i.e.*, blocking layers are interchanged for a p-i-n structure when negative voltage is applied to bias electrode; column 6, lines 50-56). Therefore it would have been obvious to one having ordinary skill in the art to provide a selenium based multilayer structure that is of the p-i-n type and the light

transparent biasing electrode is set to a negative potential in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current as taught by Schiebel *et al.*

In regard to claim **17** which is dependent on claim 6, Morton also teaches (Fig. 1) that a high voltage protective device (D1, D2) is also provided shunting the storage capacitance (column 6, lines 33-37).

In regard to claim **19** which is dependent on claim 1, the modified detector of Morton lacks an explicit description that the selenium based multilayer structure is optimized for minimum dark current and residual image. Morton teaches that it is desirable for the radiation converter (*e.g.*, a selenium based multilayer structure) to have little or no image lag (*i.e.*, residual image; column 11, lines 53-55). It is known in the art that residual image is due to dark current and modulated space charge. For example, Schiebel *et al.* teach that the selenium based multilayer structure is optimized for electrical transport without significant dark current which is defined as 1 pA/cm^2 (*i.e.*, where dark current is below 200 pA/cm^2; column 5, lines 62-66). As another example, Polischuk *et al.* teach that by blocking charge injection from the electrodes, both dark current and modulation of space charge (*i.e.*, residual image) can be minimized (column 13, lines 2-44; column 14, lines 1-20; see also Fig. 8b which shows minimal image lag in comparison to Fig. 8a). Therefore it would have been obvious to one having ordinary skill in the art to optimize the selenium based multilayer structure in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to minimize dark current (*i.e.*, below 200 pA/cm^2) and residual image (*i.e.*, less than 5%).

5. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Schiebel *et al.* (US 5,396,072) and Polischuk *et al.* (US 5,880,472) as applied to claim 6 above, and further in view of Brauers *et al.* (US 6,128,362).

In regard to claim **12** which is dependent on claim 6, Schiebel *et al.* also teaches an example of where the n layer (*i.e.*, hole blocking) has a thickness of 0.5 and 2 μm. The modified detector of Morton lacks a description in which each of the n and p layers is less than 1 μm in thickness. Brauers *et al.* teach that blocking layers can be thin but the doping must be increased to compensate for a thinner blocking layer and provides an example of where the p layer (*i.e.*, electron blocking) has a thickness of 0.1 to 50 μm (column 5, lines 5-14). Therefore it would have been obvious to one having ordinary skill in the art to provide blocking layers of thickness less than 1 μm with appropriate doping in the modified detector of Morton, in order to minimize charge injection from the electrodes so as to reduce dark current.

6. Claims 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Schiebel *et al.* (US 5,396,072) as applied to claim 1 above, and further in view of Elabd (US 5,892,222) and Rougeot *et al.* (US 5,198,673).

In regard to claims **13** and **14** which are dependent on claim 1, the modified detector of Morton lacks a photoreceptor of thickness 5-20 μm or 2-50 μm. It is known in the art that a selenium photoreceptor exhibits avalanche multiplication gain for a selected photoreceptor thickness and biasing voltage. Elabd teaches that a selenium

photoreceptor exhibits avalanche multiplication gain that depends on selected photoreceptor thickness and biasing voltage (see Table on column 5; column 4, line 65 to column 5, line 11). As another example, Rougeot *et al.* also teach that a selenium photoreceptor exhibits avalanche multiplication gain for a selected photoreceptor thickness and biasing voltage (column 4, line 67 to column 5, line 16). Therefore it would have been obvious to one having ordinary skill in the art to provide a photoreceptor of thickness 2-50 μm in the modified detector of Morton, in order to have high gain by adjusting the biasing voltage.

7. Claims 18 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morton (US 5,693,947) in view of Schiebel *et al.* (US 5,396,072) as applied to claim 1 above, and further in view of Kwasnick *et al.* (US 5,132,539).

In regard to claim **18** which is dependent on claim 1, the modified detector of Morton lacks a biasing electrode which also serves to match indices of refraction of the scintillator and the selenium based multilayer structure. Kwasnick *et al.* teach that the indices of refraction of the scintillator and the photodetector should be matched in order for the photons to readily pass from the scintillator into the photodetector (column 3, lines 16-24). Therefore it would have been obvious to one having ordinary skill in the art to provide a biasing electrode which also serves to match indices of refraction of the scintillator and the selenium based multilayer structure in the modified detector of Morton, in order for the photons to readily pass from the scintillator into the selenium based multilayer structure as taught by Kwasnick *et al.*

In regard to claim **21** which is dependent on claim 1, the modified detector of Morton lacks a housing. Kwasnick *et al.* teach that it is known in the art to provide a housing enclosing an imaging array in order to protect the imaging array from the ambient environmental and to hermetically seal the housing to provide protection in high ambient humidity environments (column 1, line 17 to column 2, line 45). Therefore it would have been obvious to one having ordinary skill in the art to provide a housing in the modified detector of Morton, in order to protect the detector from the ambient environmental as taught by Kwasnick *et al.*

Response to Arguments

8. Applicant's arguments with respect to claims 1-21 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shun Lee whose telephone number is (703) 308-4860. The examiner can normally be reached on Tuesday-Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Seungsook Ham can be reached on (703) 308-4090. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 308-7724 for regular communications and (703) 308-7724 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

SL
March 22, 2002